ABSTRACT

A process of forming a via through a inter-level dielectric layer and the product. The via is formed by etching a via hole through the inter-level dielectric layer in an area overlying a conductive feature, such a lower copper metallization. Atomic layer deposition (ALD) forms a very thin refractory metal nitride barrier layer over the sidewalls and bottom of the via. Its thickness is less than 1.5nm, and may be formed with no more than six ALD cycle. A copper seed layer is sputtered onto the barrier including the bottom portion, and copper is electrochemically filled into the hole. The barrier is thin enough to have a low electrical resistance, as may be explained by electronic quantum mechanical tunneling. Further, the crystallography and defects of the underlying copper continue across the thin barrier into the overlying copper.